Final Report
Delivery Order 168, NAS8-38609
Dennis Wingo March 13, 1997

1.0 Overview of Work Performed

1.1 Background

This work was done in collaboration with the NASA sponsor, Ms. Patrica Doty and the Marshall Space Flight Center's Small Expendable Deployer System (SEDS) project office. The research performed involved research, planning, design and development of selected components, subsystems and systems for the Students for the Exploration and Development of Space Satellite (SEDSAT). In addition, the work performed included integrating the SEDS Earth Atmosphere and Space Imaging System (SEASIS) into the SEDSAT structure and integrating the SEDSAT satellite with the NASA GSFC supplied Pallet Ejection System. After the cancellation of the MSFC SEDS mission the work continued in the same vein for SEDSAT flight as a secondary payload on the Delta II vehicle.

1.2 Specific Work Performed

The specific work performed was to develop all of the documentation necessary to support the SEDS project in evaluating the SEDSAT satellite for its suitability for flight on the Space Shuttle. The specific documentation delivered is outlined in the following list.

1. Structure
2. Thermal Analysis
3. NASA GSFC Pallet Ejection System (PES) small satellite deployer.
4. Electronics Subsystems
    - 4.1 Electrical Power Subsystem
    - 4.2 Command Data Subsystem
    - 4.3 Communications Subsystem
    - 4.4 Tether Cutter
    - 4.5 SEDS Earth Atmosphere and Space Imaging System (SEASIS)

Also included in the research was support in the form of meetings, presentation charts, travel to other NASA centers to support the development of SEDSAT as a Shuttle payload. Post cancellation of the MSFC SEDS mission, the same research has been undertaken for the new mission with Deep Space One, in assocation with JPL, GSFC, JSC and MSFC.

2.0 Research Accomplished to Support Performance of Task

2.1 Research Regarding Structure

Documentation was developed and delivered to MSFC pertaining to the structure of SEDSAT. Over 100 engineering drawings were delivered, reviewed by MSFC personnel and updated after review. A documentation database was developed which governed all of the documents submitted for this Task which enabled MSFC to determine the completeness of the submitted material. Since the cancellation of the MSFC SEDS mission and Headquarters reassignment of SEDSAT to the Delta II our activities have progressed. The SEDSAT structure has been approved for flight on the Delta II and verification activities are in progress.

2.2 Thermal Analysis

Thermal Analysis results consistent with the requirements of MSFC and GSFC for early stages of design and development were submitted. Worst case environments were outlined and problem areas were identified.

2.3 Research Regarding NASA GSFC PES

The SEDSAT satellite interface was successfully integrated with the GSFC PES design. Coordination, in the form of documents, reviews and hardware interface tests were conducted during the Task period. All RIDs generated during the review process were disposed of and NASA MSFC and GSFC approved our interface design and its suitability for flight on the Shuttle. After the cancellation of the MSFC SEDS mission, SEDSAT cleared Phase 0/1 safety as was ready for phase II review. This activity has since transitioned to meeting the safety requirements for the Delta II Marman clamp interface.

2.4 Electronics Subsystems

All documentation necessary for the review of the SEDSAT satellite electrical systems were submitted as part of the review process. These documents were reviewed by MSFC EB personnel as well as the SEDS project office. Documents relevant to the Shuttle safety process were reviewed by NASA GSFC and JSC safety panels. These documents were then updated, reflecting changes recommended by these organizations and the updated documents were approved by MSFC, GSFC and JSC. This work has progressed with the new mission and requirements levied by the Delta II vehicle.

2.5 SEASIS Integration

The SEASIS instrument integration into SEDSAT was a second principal task within the Task Order. This was accomplished in the task period. An end to end demonstration for MSFC and Headquarters personnel was successfully held in August 1995. After this documentation and designs were updated to conform to NASA safety requirements relative to flying the instrument as a Shuttle Payload. Software and hardware was developed to enable the completion of the instrument consistent with the delivery schedule of the satellite for flight on STS 85. Also, documentation regarding the safety of the instrument as a shuttle payload were submitted and approved by MSFC, GSFC and JSC. After the cancellation of the STS mission in the summer, updated documentation, schedules and work plans have been developed consistent with requirements to fly on the Delta II

3.0 Summary and Conclusion

The work proposed in this task order was successfully accomplished. This is reflected in the approval by three NASA centers of the SEDSAT satellite to fly as a payload on the shuttle. All documentation necessary for evaluation of the satellite as a Shuttle payload was submitted and approved by the appropriate safety boards. The SEASIS instrument was demonstrated to work and its inclusion as a SEDSAT payload was accomplished in the task period. Finally, the SEDSAT interface to the NASA GSFC PES was approved by MSFC and GSFC with no substantive issues outstanding. As of the end of the contract date all milestones were met. However the NASA MSFC SEDS program was canceled by the center. Since that time SEDSAT has gone on to be manifested on a Delta vehicle.

Submitted by Dennis Wingo

3-13-97
Date